2) Recharge

a) Introduction

The "recharge" component of the Ground Water Vulnerability Model represents water that penetrates the ground surface and percolates to the water table below (Figure 4). The recharge component can be difficult to assess but is crucial for vulnerability evaluation. Recharge may transport contaminants from the surface, therefore, the higher the volume of water that penetrates the ground surface the higher the possibility of contaminants reaching the aquifer. Many recharge models use multiple data inputs such as precipitation, air temperature, and conveyance loss. Much of this data is site specific and expensive to obtain.

The most cost effective method to rate recharge in the Snake River Plain was to classify the various land cover types such as man made irrigation, forestland, dryland agriculture, rangeland, etc. On the Snake River Plain, precipitation is generally less than 10 inches per year, hence precipitation supplies very little recharge to the aquifers. Man made irrigation is a much greater component of recharge to the Snake River Plain. By classifying the different types of land cover, a good estimate of relative amounts of recharge can be developed that meets the needs for ground water vulnerability assessment.

It is important to note that using land cover as an estimate for recharge combigns factors from natural sources (rangeland, dryland agriculture, forest, etc.) and man made sources (gravity and sprinkler irrigation). As time progresses the man made portion of recharge can change significantly, whereas the natural component of recharge should remain relatively the same. This combination of natural and man made sources makes the recharge layer a combination of susceptibility and contaminant loading potential.

b) Overview of Methods

The "recharge" map combined three digital layers, or maps, that indicated types of land cover. The first layer outlined Irrigated and Dry Agricultural Stratum for Southern Idaho (Agricultural Stratum). This information was mapped by the Idaho Department of Water Resources. It was produced by delineating irrigated and dry farmland areas from 1:250,000 Landsat False Color Composite (FCC) images flown in 1986.

The second layer consisted of Irrigation Water Management (IWM) data developed by the USDA Soil Conservation Service. This layer represents irrigated farmland as either sprinkler-

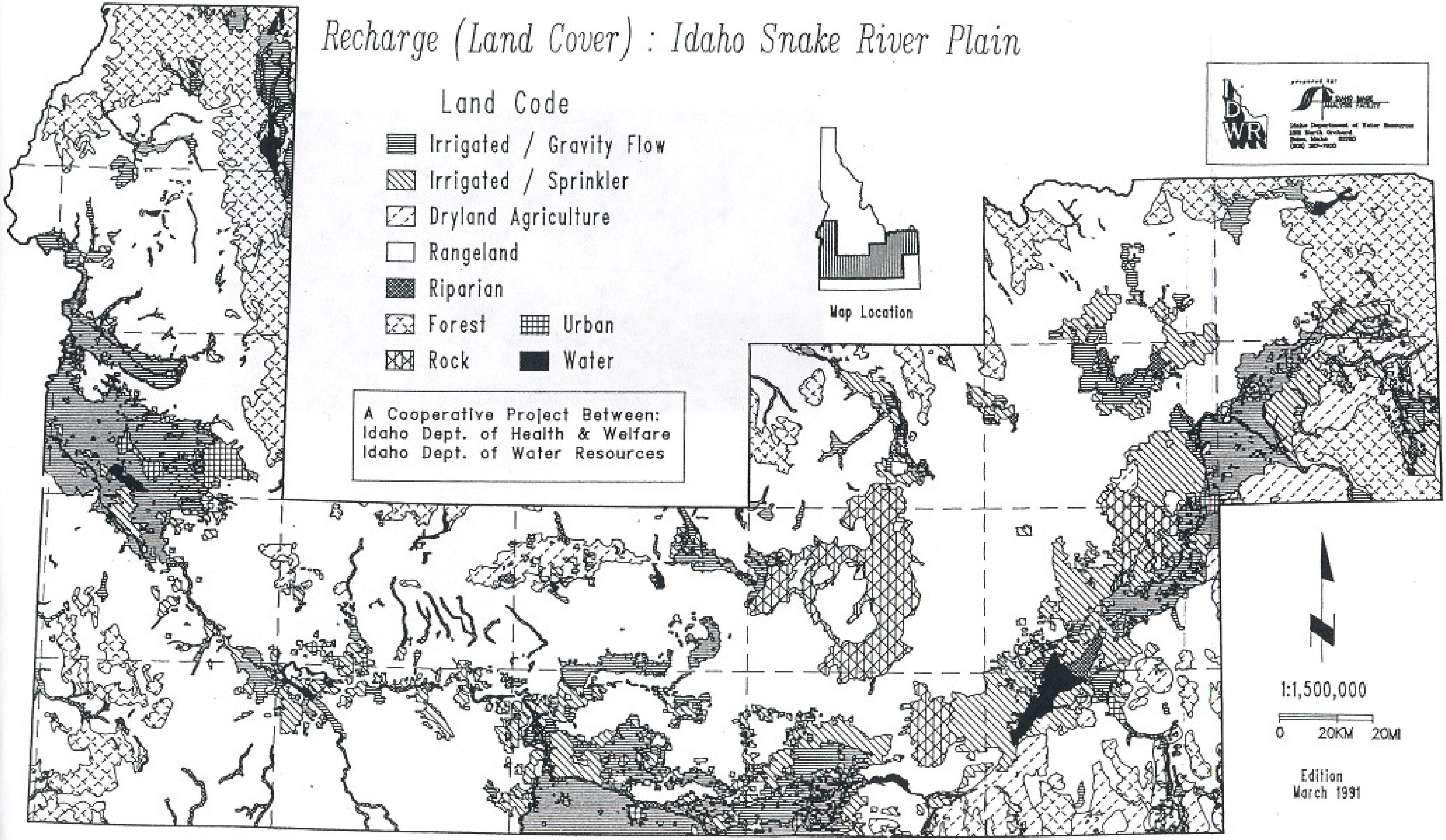

Figure 4: Recharge map Snake River Plain, Idaho.

or gravity-fed water delivery systems. The data were field checked for accuracy and mapped in 1983. Knowing the type of delivery system allowed the recognition of land with differences in water application rates. Generally, the gravity-fed systems apply water to the land at a higher rate than sprinkler systems. The rate of application is important because the higher the rate, the greater the recharge to the underlying aquifers.

The third layer was the Actual Vegetation Map of Idaho created by Steve Caicco (IDWR, in press). This layer was mapped at a scale of 1:500,000, so areas smaller than 1750 acres were not mapped. It contains over 118 vegetation types, categorized by species. The level of detail made the map too cumbersome for the vulnerability model because the scope of this project did not include differentiation of individual plant species. Thus, the specific vegetation types were aggregated into five general categories representing rangelands, agricultural lands, forests, lava flows, and riparian areas. For example, Whitebark Pine, Mountain Hemlock, and Lodgepole Pine were aggregated into the "Forests" category.

The joining of these three layers divided the region into irrigated and non-irrigated land. Irrigated lands were further divided into gravity- and sprinkler-fed water delivery systems. Non-irrigated land was divided by vegetation type with recognized levels of required precipitation. Each of these divisions isolated in some way the level of water applied and thus the aquifer recharge component.

c) Discussion

<u>The Halo Effect</u>

When joining the three layers of the recharge component, the outer boundaries of many regions did not match because the layers were based on different source data, and created at different times. The overlapping data produced a "halo" effect resulting in an indistinct boundary between areas of different land cover. When the "halo" was caused by conflicting source data, the IWM information was used because of its larger scale and greater accuracy.

Although more precise, the IWM was based on older information. To correct "time halo" effects, Landsat False Color Composite images(FCC's), aerial photos, and the comparison of adjacent areas were evaluated to determine irrigation system type.

<u>Towns and Lakes</u>

Urban and lake areas were left out of the vulnerability model for rating purposes and were used only as location markers on the final maps. Recharge in urban areas is much more diverse and site-specific than in the broader land cover types.

Therefore it was decided that the rating of these urban areas should be left to a more in-depth study or model.

d) Rating System of Recharge Layer

The "recharge" map was generated by merging the three sources of information on land cover. Each resulting recharge class was given the following point rating to be used in determining relative vulnerability. The sources of highest recharge were given the highest point rating. These point ratings may be adjusted in the future after comparison to ground water monitoring data. Figure 4 shows the distribution of these classes throughout the Snake River Plain.

Recharge Classes	Rating (points)
Gravity-fed irrigated land	50
Riparian areas	50
Sprinkler-fed irrigated land	40
Forests	30
Dryland agriculture	20
Rangeland	20
Bare rock (lava flows)	10
Urban areas	No rating
Surface water	No rating

3) **Soils**

a) Introduction

The soils layer is an important factor in determining ground water susceptibility because it acts as the first barrier to potential ground water contamination. For the purposes of this project, contaminants were assumed to have the same mobility and characteristics as water. Additional data layers can be developed in the future to evaluate the migration of specific classes of contaminants, whether it be solvents, various types of pesticides, or petroleum hydrocarbons. This study defined the soil layer as the uppermost 60 inches (5 ft) of land surface.

The Idaho Ground Water Vulnerability Project incorporated the State Soils Geographic Database (STATSGO) and SOILS-5 database developed by the U.S.D.A. Soil Conservation Service (SCS). STATSGO is a general soils database which consists of two parts; a spatial (map) component based on USGS topographic maps at a scale of 1:250,000, and an attribute data base consisting of tabular soils data. The SOILS-5 database was the source for the tabular soils data for STATSGO. SOILS-5 provides information on a broad range of chemical and physical